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ABSTRACT

A systems approach, a multiparameter stochastic model, that will project State vocational education needs is being developed in Washington State by cooperation of the Coordinating Council for Occupational Education with Dr. Samuel Cleff. The model has incorporated the Cleff Career Development Systems (CCDS), a job matching system used for individual guidance in subprofessional occupational selection that develops 16-point numerical profiles of jobs, training courses, and of people. A mathematical cluster of 750 CCDS job profiles resulted in 19 job profile clusters. Because of the behavioral similarity of jobs within a specific cluster, it was inferred that transfer of training would be high from one job to another within that cluster. Through profiling, a job or set of jobs can be assigned to one of the 19 clusters. As labor market data can be reduced to mathematically related qualities, data collection, analysis, and model refinement can be readily pursued. The transfer of training inference also implies the possibility of cross-training students to perform well in several jobs within their matched job clusters. Profiling can be used for vocational guidance of students, curriculum and course planning, and for matching graduates with open jobs, as well as providing raw material for forecasting. (Author/EA)

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# ENROLLMENT FORECASTING

A Report of the
National Dissemination Project
for the Community Colleges

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# INTRODUCTION

Every large organization that delivers an end-product must organize the [illegible] of the resources necessary to turn out that [illegible]. The process is complicated if there is a shifting [illegible] for the product and shifting supplies of resources over time. Most such organizations expend a good deal of effort attempting to control both the sources of supply and the markets. Complete control is obviously impossible in most situations; therefore, the organizations are forced to attempt to forecast or predict these external circumstances so that they can adapt to the shifts at lowest possible cost to the organization. Cost is expressed in terms of underproduction as well as overproduction. In either case the capital expenditures are inappropriate.

An educational system which is trying to prepare students for occupations and jobs is in an analogous position. There is no need to belabor the parallel in end-products and capital expenditure. The educational system must provide the prepared workers for industry, the student for work. It may supply too many or too few prepared students for specific jobs. In either case, it has made inappropriate use of capital expenditures--in

this case, taxes. Planning and forecasting is as important to the "educational plant" as to the industrial plant--perhaps more so since much of the unmeasured cost is in terms of human disadjustments and anxiety.

Recognizing this, vocational educators have come to assume in recent years that manpower forecasting constitutes a natural part of their function if they are to better the performance of the vocational education industry.

Somers (1968) observes that vocational education reacts only sluggishly to industrial change, and a good part of this slow reaction can be attributed to bad data.

Numerous sources of manpower data and forecasting models of various degrees of sophistication are available on the market today. However, much data is improperly gathered and most models are inadequate to meet the needs of vocational education planners as well as the employer.

It is natural to inquire which of the techniques, if any, offer special promise for vocational planners who want to know something about the future. Why do vocational education planners need to forecast? The following questions give rise to forecasting needs:

1. <u>How many students should be admitted to each specialty?</u> On the investment side, in what curricular

areas should physical and staff capacity expansion be undertaken?

2. What will be the impact on vocational education programs resulting from changed patterns of participation by previously excluded groups such as Blacks, Chicanos, Native Americans, and women? The spirit of recent manpower legislation implies that government agencies directly concerned with training and developing human resources should commit themselves to positive action in the field of minority employment.

3. What is the appropriate design for a given curriculum? Will industry's production techniques change in ways that render today's curriculum "mix" obsolete in five years? It has been shown that little occupational forecasting and follow-up enters into the curriculum plans of vocational educators.

4. What are the employers' alternative sources of supply in an occupation for which vocational education is being provided? Are these patterns subject to change over time, responding to different market and institutional forces?

5. From what sources will teachers and administrators come and how will this supply change with changes in labor market conditions?

The vocational educator will, no doubt, continue to be dependent on skill survey sources for data on the job market. He should bear in mind weaknesses in the data base which have been outlined. He should remember that the very act of surveying may alter his forecast, and he should decide whether or not his forecasting needs are fulfilled by a technique which produces no labor supply information past a three year range.

It is rather alarming to note that forecasting tools that work beyond the two-to-three year range do not exist in vocational or occupational education. It is possible to make over-all estimates of the numbers of students to be expected five to seven years hence but is notoriously impossible to predict with accuracy better than chance the jobs or even the job families for which students should be trained. Traditionally planning takes place by hind-sight rather than foresight to the great cost of our educational institutions and the dislocation and pain of our students.

One very important reason for this inability to predict or forecast appears to be the lack of system in job description, course identification, and student need and potential. At present, using the Dictionary of Occupational Titles job descriptions and codes demands

information about thousands of jobs which may go by different titles in different companies. The D.O.T. provides no rational way to relate people to jobs or courses of training. Job clustering now takes place on the basis of industry or some ad hoc intuitive and subjective grouping. The situation is a mathematical horror!

## THE MULTI-PARAMETER STOCHASTIC MODEL

There is a new approach, however, which may provide a base for rational and mathematically modeled forecasting. In Washington State the Coordinating Council for Occupational Education (CCOE) is cooperating with Dr. Samuel Cleff, a long-time researcher for ADP Personnel Data Systems in New York, to develop a multi-parameter stochastic model that will project vocational education needs for the state.

The CCOE-Cleff Model is based on an initial statement of forecasting problems, including:

1. The lack of meaningful methods of accurately projecting occupational training needs from industrial and labor market data.
2. Lack of uniform training period among institutions for a given occupation.
3. A significant time lag between completion of training and employment.
4. An emphasis upon training which locks individuals into a single occupation rather than upon skill training which allows occupational flexibility.
5. A lack of information on the general economic factors influencing the "training climate."
6. A lack of basic information on the trainee's background and preferences.

The model also incorporates the Cleff Career Development Systems (CCDS), a job matching system used to guide the individual in the selection of an occupation to meet his needs. The CCDS is based on a set of 16 behavioral activity variables which were developed so as to be common to persons, jobs, and job training situations. It was specifically designed for those jobs considered to be sub-professional and which demand less than one year of full-time training on the job. The CCDS develops 16 point numerical profiles of jobs, training courses, and of people. It is this mathematical characteristic of its qualitative pattern measurement that makes it useful for large-scale analysis problems such as forecasting.

A mathematical cluster analysis of 750 CCDS job profiles, all collected by CCDS instrumentation on live jobs resulted in 19 job profile clusters. Examination of the job titles in each cluster revealed a "common sense" as well as a mathematical relationship. More important, it may be inferred, because of the behavioral similarity of the jobs within a specific cluster, that transfer of training would be high from one job to another within that cluster. This inference is critical to our overall task of preparing students for jobs and our

immediate task of developing an enrollment forecasting mathematical model. Through profiling, a job or set of jobs can be assigned to one of the 19 clusters. The same is true of the people involved, as well as the courses. Once the data of the labor market can be reduced to mathematically related or relatable qualities, it becomes a relatively simple matter of data collection and analysis for a mathematician to develop the first "cut" at a mathematical model which can be tested against reality, modified as necessary, and refined. The transfer of training inference has further implication for the internal management of the education and training process. Instead of preparing a student for one job, it should be possible to cross-train him to perform well in several jobs within the job clusters to which he matches the best. Thus, an adequate forecasting model will minimize the danger of training a student for a non-existent job and maximize his likelihood of getting a job which fits one of his several skills. Educationally, this means an emphasis upon developing the student's potential rather than merely making him suitable for a specific job which could disappear next month.

There are adaptations which any organization must make in order to increase the accuracy of its forecasting

and therefore its economic survival. Data for the forecast must be systematic, logically related to means and ends, easy to gather, and disciplined. This is a difficult task for most organizations to achieve; it may be impossible for the traditionally disorganized, illogical, and undisciplined data collection of educational organizations.

Specifically, in order to use the CCOE-Cleff Model, it will be necessary to maintain continuous record of the profiles of jobs which open and close on a sampling basis. Eventually, a large proportion of the people going into those jobs must be profiled as well--this can be done as they pass through the educational system. Profiling is inexpensive and takes little time, but can be used for vocational and educational guidance of students, for adjusting courses to the realities of the jobs for which the course is purportedly training students, and finally for matching graduates with open jobs. The data generated by this system's approach to career education will also be the raw material for the forecasting system. This would result in better planning for vocational education as well as a better way of looking at the problem of "relevant" vocational education.